

Anthropology and Anatomy at Olduvai, Kenya

Scalpel and Tongs, Jan-Feb 1994
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Olduvai, on the edge of the Rift Valley, Kenya, is the center of anthropological and anatomical research by Louis and Mary Leakey and their son Richard. Many specimens are in the National Museum, Nairobi.

Three exhibits are of especial interest.

1. The huge hip bone of a fossilized Proboscidian elephant, *Elephas reeki*. The acetabulum sits almost horizontally. Frequent pounding in antiquity with a very hard object has irregularly fractured the compact bone. This is believed to be the first known example of the modern mortar and pestle.
2. A long bone exhibited in the National Museum shows an irregular superadded layer of periosteal cortical bone. Chronic Vitamin A intoxication, the result of ingesting large prehistoric animal livers is the cause. Polar bear liver, rich in Vitamin A, is also hallucinogenic and disinhibiting. Perhaps primitive man also enjoyed such effects. The polar bear, prehistoric animals and Vitamin A rich botanicals have rich philatelic representations.

Galileo, one time medical student, questioned whether the universe revolved around the earth at peril to himself. While under house arrest in 1638, Galileo, who had never heard of dinosaurs, proved the weight bearing bones of an animal that increases in size must thicken disproportionally to maintain the same relative strength. Specimens found at Olduvai provide practical proof of that.

Darwin (1) caused major controversy by hypothesizing man and apes had a common ancestor. Current researches in molecular biology (2) show man and chimpanzee had a common origin as recently as five million years ago. In terms of D.N.A. sequence homology there is but a 1% difference between the chimpanzee and gorilla and a 1% difference in the encodement that separates homo sapiens from the gorilla and chimpanzee. This is appropriately called the "monkey puzzle" (3).

Hominids and the great apes diverge from the hominoids or primates. Man evolved from the hominids. The arboreal primate environment demanded limbs with prehensile hands and feet. Nails replace claws. Olfaction becomes unimportant with regression of the snout. The moist broad Platyrrhine Rhinarium is replaced by the smaller dry narrow Catarrhine dry nose with much reduced turbinates and vertical nostrils. Vision becomes very important. The eyes, displaced from the lateral to a central position allow overlapping visual fields and stereoscopic vision. The face and jaws become reduced to allow for the increase in size of the cranial cavity. Dentition is much modified. Upright posture develops.

Most importantly the brain becomes progressively more complex leading possibly to more thought, language and wide choices of response. Simple tools evolved from sticks and stones. The chimpanzee may use leaves to wipe dirt from dry skin, may use them to gather fluids, may

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insert a straw into a hole and draw it out covered with edible termites, or may throw sticks as weapons. (4)

Most important of the finds, are four skulls, anatomically correct, shown on Kenya 198 S.G. 225-8.

1. The Miocene Dryopithecine Hominoid

Proconsul africanus found in 1948 by Mary Leakey at Rusinga Island, Lake Victoria is both proto-ape and proto-man. It was originally thought to be the missing link. The jaw has large peg like canines, each overlocking the other, precluding lateral jaw movements. Incisors are large molars relatively small with thin enamel suggesting a forest dwelling fruit eater. *Proconsul* evolved in East Africa some 17 million years ago. The first upright apes did not evolve until some four million years ago. It is unknown what happened in that large time gap. Possibly as world temperatures fell, forests and *Proconsul* disappeared.

2. *Australopithecus boisei* also known as *Zinjanthropus*, "Nutcracker" and "Dear Boy" is about the size of female gorilla. Mary Leakey found this fragmented skull in 1959 at Olduvai.

In 1969 Richard found another near-perfect specimen. The jaw protrudes, molar and premolar teeth are large. Small non-projecting canines allow the jaw to rotate. Dentition is consistent with herbivorous diet. Teeth are large compared to man's, small compared to ape's. Length of arm bones confirm this was a two-legged ape, occasionally quadruped. The cranial cavity is relatively small. Stance was more upright than in living apes. The position of the foramen magnum enabled the head to balance upright on the vertebral column.

A. boisei was a tool user as opposed to a tool maker. Appearing about two and a half million years ago he represents a blind path. He became extinct about one million years ago because of climatic changes - the absence of tools suitable for a meat diet and competition from baboons and homos may have been factors.

3. *Homo habilis*, "skillful man", has a cranial cavity of about 800cc as opposed to 450-550ccs of *A. boisei*. Appearing about 2 million years ago, he lasted about one million years and was again wrongly thought by Louis Leakey to be the missing link. The first skull was found by Louis Leakey at Olduvai in 1962. However not until Bernard Ngeneo, in 1972, found the skull labeled 1470, was it clearly shown that the ratio of the volume of the cranial cavity in relation to body size is greater than in *A. boisei*.

Skull 1470 is one of the earliest examples of a large brain hominid. Slender, agile but smaller than *H. erectus* or *H. sapiens*, thumbs are fully opposable and posture upright. A meat eater, he is thought to be the first of the line leading to modern man. *Australopithecus* and *Homo habilis* are found in the same geological strata showing they are contemporary, but the former is not the ancestor of the latter. *Homo habilis* made simple tools.

4. *Homo erectus*, found by Ngeneo in 1975 evolved about one and a half million years ago and is more advanced. The cranial cavity is about a thousand ccs. *H. erectus* replaced *H. habilis* but coexisted with *A. boisei* in East Africa. The forehead slopes backwards. The poorly developed

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chin is characteristic of *H. sapiens*. The skull is very thick. The skeleton resembles that of a modern man but the phenotype is still stockier. He had the skill to give stones a cutting edge facilitating butchering and meat eating. The use of one stone to shape another transformed technology and enabled hunting and skinning of large animals. He also used fire.

Homo sapiens is about 130000 years old. The cranial cavity size is about 1400 ccs., the occiput acute angled, the supraorbital ridges prominent. Evolutionary developments in the skull permit increasing size of the brain. The brain surface area increases with convolutions. Markings in the anterior and middle cranial fossae, especially if asymmetrical, give clues as to the development of the frontal and temporal lobes, justifying hypotheses about hand-brain coordination, tool making, speech and interspecies co-operation.

There is shortening of the craniofacial skeleton. The occipital condyles shift forwards. Change in the foramen magnum, especially vertical in the quadruped, essentially horizontal and more central in man, allows both the upright posture and freedom of movement of the upper limbs. Cerebral asymmetry, the left brain being larger than the right brain, occurs very late in evolution. In the lower species of Primates, e.g., the baboon, the brain weight generally increases proportionally to the increase in body weight and surface area.

However at a point in evolution the increase in the brain weight is much greater than expected. In great apes the brain weight has increased out of proportion to what would be expected by the increase in the body weight. In the hominid species *Australopithecus boisei*, *Homo habilis*, *Homo erectus* and *Homo sapiens* the increase in the brain weight is out of proportion to anything that has gone before. The brain weight progressively increases from *A. boisei* to *H. sapiens*.

It must be remembered that the surface area of the brain is much increased by the convolutions and fissures. This illustrates the fallacy of brain volume alone as a measure of cerebral development. The histology of the cortex is six layered in *H. sapiens*, only four-layered in any other extant species. The last two layers of the cerebral cortex are the last to develop in evolution, the last to develop in the foetus, the first to be involved in degenerative brain disease. The anatomical basis for morality and conscience resides in those layers and their circuits.

Other stamps about medical anthropology illustrate Hrdlicka holding a skull, (Czechoslovakia 1969), Rivet (Ecuador 1958) and Buck (New Zealand 1990)

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